

APPENDIX B

ECOLOGICAL HAZARD METHODOLOGY

This appendix provides further background on the development of hazard profiles and determination of the concern concentration.

B.1 DEVELOPMENT OF HAZARD PROFILE

Chapter 3 presented a hazard profile consisting of three chronic and three acute effective concentrations representing acute and chronic values for fish, aquatic invertebrates (daphnid), and algae for each chemical. For most of the chemicals in the Cleaner Technologies Substitutes Assessment, measured values from studies were generally not available, and structure-activity relationships (SARs) were used instead as predictive measures.

SAR methods include Quantitative Structure Activity Relationships (QSARs), qualitative SARs, or use of the best analog. The use of SARs by USEPA's Office of Pollution Prevention and Toxics (OPPT) has been described (Clements, 1988). The use and application of QSARs for the hazard assessment of new chemicals has been presented (Clements et al., 1993a). The development, validation and application of SARs in OPPT have been presented by OPPT staff (Boethling, 1993; Clements et al., 1993b; Lipnick, 1993; Nabholz et al., 1993; Newsome et al., 1993; Zeeman et al., 1993).

The predictive equations (QSARs) are used in lieu of test data to estimate a toxicity value for aquatic organisms within a specific chemical class. The equations are derived from correlation and linear regression analysis based on measured data; however, the confidence interval associated with the equation is not used to provide a range of toxicity values.

B.2 DETERMINATION OF CONCERN CONCENTRATION

Concern concentration (CC) is the concentration of a chemical in the aquatic environment that, if exceeded, may result in a significant risk. Concern concentrations are determined by applying assessment factors (USEPA, 1984) to the effect concentrations in the hazard profile. These assessment factors incorporate the uncertainty associated with toxicity data, laboratory tests versus field tests, measured versus estimated data, and species sensitivity. For example, if only a single LC_{50} value for a single species is available, there are several uncertainties to consider. First, how good is the value itself? If the same laboratory or a different laboratory were to redo the test, would the value differ? Second, there are differences in sensitivity (toxicity) among and between species that have to be considered. Is the species tested the most or the least sensitive? In general, if only a single toxicity value is available, there is a large uncertainty about the applicability of this value to other organisms in the environment, and a large assessment factor (e.g., 1,000) is applied to cover the range of sensitivity known to exist among and between organisms in the environment. Conversely, more information results in more certainty concerning the toxicity values and allows the use of a smaller assessment factor. For example, if toxicity values are derived from field tests, then an assessment factor of one is used.

USEPA uses four assessment factors to set a CC for chronic risk: one, 10, 100, and 1,000. The assessment factor used depends on the amount and type of toxicity data contained in the hazard profile and reflects the amount of uncertainty about the potential effects associated with a toxicity value. In general, the more complete the hazard profile and the greater the quality of the toxicity data, the more likely that a smaller assessment factor is used. The following describes the use and application of the assessment factors:

1. If the hazard profile only contains one or two acute toxicity values, the CC is set at 1/1,000 of the acute value.
2. If the hazard profile contains three acute values (base set), the CC is set at 1/100 of the lowest acute value.
3. If the hazard profile contains one chronic value, the CC is set at 1/10 of the chronic value if the value is for the most sensitive species. Otherwise, it is 1/100 of the acute value for the most sensitive species.
4. If the hazard profile contains three chronic values, the CC is set at 1/10 of the lowest chronic value.
5. If the hazard profile contains a measured chronic value from a field study, then an assessment factor of 1 is used.

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